SYSTEM AND METHOD FOR PRODUCING FOAMED AND STEAMED MILK FOR HOT BEVERAGES

Technical Field

[0001] The present invention relates generally to a beverage system and more particularly relates to systems and method for producing foamed and steamed milk for beverages.

Background of the Invention

[0002] Hot beverages such as cappuccinos and lattes are becoming increasingly popular. Commercial businesses from fast food restaurants to coffee houses are providing these hot beverages to their customers. Although hot beverages may be made in sufficient quantity for a high volume restaurant, many customers may prefer a freshly brewed beverage. Likewise, these customers also may prefer freshly made foamed or steamed milk in their hot beverage. The foamed or steamed milk generally is of higher quality if it is made fresh for each customer. However, current technology may not produce foamed or steamed milk quickly or efficiently enough to satisfy consumer demands.

[0003] Generally described, foamed milk may be produced using steam, milk, and air, whereas steamed milk is produced using only steam and milk. Specifically, steam, milk, and/or air may be forced through a single venturi orifice. The steam, milk, and/or air may then be mixed as they pass through the single venturi orifice. The milk, steam, and/or air, however, may not be sufficiently mixed. Insufficient mixing may introduce inefficiencies that result in some of the milk not being converted to foam. Furthermore, it may take a considerable amount of time to produce the foamed or steamed milk by forcing the steam, milk, and/or air through the single venturi orifice.

[0004] What may be desired, therefore, is a foamed or steamed milk dispenser that can produce foamed and steamed milk in an efficient, high quality, and high speed manner to individual consumers in individual servings. The

device, however, preferably should be easy to use, easy to maintain, and be competitive in terms of cost.

Summary Of The Invention

[0005] The present invention thus provides a foamed milk system for creating foamed milk from a source of milk, a source of air, and a source of steam. The system may include a milk inlet system for pressurizing the milk, an air inlet system for pressurizing the air, a mixing area to mix the pressurized milk, the pressurized air, and the steam, and an expansion area to expand the mixture of the pressurized milk, the pressurized air, and the steam.

[0006] The milk inlet system may include a peristaltic pump. A disposable hose may connect the peristaltic pump and the source of milk. The air inlet system may include an air pump. A hose connector may connect the milk inlet system and the air inlet system. The hose connector may include a three-way or a four-way valve. The hose connector may include a number of barbed connections. The milk inlet system and the air inlet system may both include disposable hoses connecting the hose connector. The disposable hose for the air inlet system may include a microfilter and one or more check valves. A disposable hose also may connect the hose connector and the mixing area. A steam hose may connect the source of steam and the mixing area.

[0007] The mixing area may include a hollow nozzle block. A mixture nozzle may be positioned within the hollow nozzle block. The mixture nozzle may include a number of protrusions positioned thereon and a number of orifice area positioned about the protrusions. The mixture nozzle may be removable.

[0008] The foamed milk system further may include a diffuser to gather the flow of the foamed milk to be dispensed. The diffuser may include a diffuser insert and a spout.

[0009] The foamed milk system further may include a sanitation system. The sanitation system may include a source of hot water. The hot water flows through the mixing area and the expansion area via a sanitation hose.

[0010] A further embodiment of the present invention provides for a steamed milk system for creating steamed milk from pressurized milk and steam. The system may include a mixing area to mix the pressurized milk and the steam, a pressurized milk inlet system for injecting the pressurized milk into the mixing area, a steam inlet system for injecting the steam into the mixing area, an expansion area to expand the pressurized milk and the steam to form a flow of steamed milk, and a diffuser to gather the flow of the steamed milk to be dispensed.

[0011] A method of the present invention may provide for a sanitizing a dispenser serving foamed milk from a source of pressurized milk and a source of pressurized air. The pressurized milk and the pressurized air may be fed through a number of hoses and mixed together in a mixing nozzle. The method may include providing a source of hot water, connecting the source of hot water to one or more of the number of hoses, flowing the hot water through the one or more of the number of hoses and the mixing nozzle, disconnecting the source of hot water, and repeating the above steps on a predetermined schedule.

[0012] The predetermined schedule may include about every two (2) hours. The hot water may include about 190 degrees Fahrenheit (about 87.8 degrees Celsius). The method further may include the steps of replacing the number of hoses on a second predetermined schedule. The second predetermined schedule may include about daily.

[0013] A further method of the present invention may provide for producing foamed milk from milk, air, and steam. The method may include pressurizing the milk and the air, injecting the pressurized milk, the pressurized air, and the steam into a mixing area, and depressurizing the milk, air, and steam mixture to ambient pressure to create the foamed milk.

[0014] These and other features of the present invention will become apparent upon review of the following detailed description when taken in conjunction with the drawings and the appended claims.

Brief Description of the Drawings

[0015] Fig. 1 is a schematic view of the foamed milk system of the present invention.

[0016] Fig. 2 is a plan view of the mixing nozzle insert shown with the nozzle block in cross-section.

[0017] Fig. 3 is a perspective view of the nozzle insert and protrusions.

[0018] Fig. 4 is a perspective view of an alternative embodiment of a cleaning block junction.

Detailed Description of the Invention

[0019] Briefly described, the present invention injects pressurized milk, air, and steam into a mixing area of a nozzle body. The milk, air, and steam may be intimately and thoroughly mixed within one or more orifice areas. The mixture then proceeds to an expansion area where the mixture expands to ambient pressure. The expansion causes the milk to foam. The foamed milk may then be collected with a diffuser and dispensed into a cup. The present invention also can be used to produce steamed milk only by introducing steam and milk to the foamed milk system.

[0020] Referring now to the drawings in more detail, in which like numerals represent like elements throughout the several views, Figs. 1-3 show a foamed milk system **100** of the present invention. The foamed milk system **100** may include a pressurized milk inlet system **110**. The pressurized milk inlet system **110** may provide pressurized milk to the foamed milk system **100** as a whole. The pressurized milk inlet **110** system may include a milk supply **120**, a milk pump **130**, and a plurality of milk hoses **140**, **150**. The milk inlet system **110** may be positioned within a refrigerated container **155**. The refrigerated container **110** may be any type of standard refrigeration system. The milk supply **120** may include any type of container, including a carton, a bag in box, or any other type of storage device. The milk itself may be UHT (Ultra High Temperature) milk. The milk preferably is maintained at about 40 degrees

Fahrenheit (4.4 degrees Celsius) or lower after opening. The milk preferably is replaced when the milk supply **120** is empty or about every 48 hours or so.

[0021] The milk hoses **140, 150** may be made out of rubber, copper, stainless steel, other types of metals, plastics, and other types of substantially non-corrosive materials. The materials preferably are food grade. The hoses **140, 150** preferably are disposable. Although any length may be used, the hoses **140, 150** preferably are as short as possible to limit the length the milk must travel out of the milk supply.

[0022] The first milk hose **140** may connect the milk supply **120** to the milk pump **130**. The milk pump **130** may pressurize and meter the milk. The milk may be pressurized between about two (2) and about forty (40) pounds per square inch (psi) (about 0.14 to about 2.8 kilograms per square centimeter (ksc)) depending on the flow rate desired. The present embodiment may pressurize the milk to about fifteen (15) psi (about one (1) ksc). The milk pump **130** may be a peristaltic pump to better meter the milk. The peristaltic pump also may have the advantage of reducing the risk of backflow and, hence, reducing the risk of somehow contaminating the milk. Any other type of pump that pressurizes and meters the milk is contemplated for use herein.

[0023] The foamed milk system **100** also may include a pressurized air inlet system **160**. The pressurized air inlet system **160** may provide pressurized air to the foamed milk system **100**. The air may be pressurized to between about two (2) and about forty (40) psi (about 0.14 to about 2.8 ksc) using an air pump **170** depending on the desired flow rate. The present embodiment may pressurize the air to about fifteen (15) psi (about one (1) ksc). The air pump **170** may be any pump design that provides compressed air. The pressurized air may be delivered via an air hose **180**. The air hose **180** may include a microfilter **175** or a similar type of device to remove any impurities in the air stream.

[0024] The pressurized milk and the pressurized air may be combined and pre-mixed. The pressurized milk inlet system **110** and the pressurized air inlet system **160** may be joined at a hose connector **185** via the second milk hose **150** and the air hose **180**. The hose connector **185** may include three (3) hose fittings

190, 200, 210. Any type of three (3) way valve may be used. The milk hose **150** may connected the output of the milk pump **130** and the first hose fitting **190**. The air hose **180** may connect the output of the air pump **170** and the second hose fitting **200**. The pressurized air and pressurized milk may be combined into one stream in the hose connector **185** to allow the mixture to exit through the third hose fitting **210**.

[0025] As described above, the hose connector **185**, the milk hose **150**, and the air hose **180** may be made out of copper, stainless steel, other types of metals, plastics, rubber, and other types of substantially non-corrosive materials as described above. These elements may be detachable to allow for easier cleaning. The hose fittings **190, 200, 210** and the other connections described herein may be barbed and may include polished surfaces to prevent crevice accumulation. The hoses **150, 180** preferably are disposable. The length of the hoses **150, 180** preferably is as short as possible.

[0026] A mixture hose **220** may connect the hose connector **185** to a mixture inlet **230** of a nozzle body **240** to transport the milk and air mixture. The mixture hose **220** may be made out of copper, stainless steel, other types of metals, plastics, rubber, or other types of substantially non-corrosive materials as described above. The hose **220** preferably is disposable and as short in length as possible. The mixture hose **220** may be attached to the nozzle body **240** by fitting the mixture hose **220** into the mixture inlet **230**. Alternatively, a clamping mechanism or any other method to secure the mixture hose **220** in the mixture inlet **230** known in the art may be used.

[0027] The nozzle body **240** may be a substantially hollow block-like structure. The nozzle body **240** may be made out of stainless steel, aluminum, plastic, or any other substantially non-corrosive material. The nozzle body **240** may include an inner wall **250** and an outer wall **260**. The inner wall **250** may define a mixing area **310** as will be described in more detail below. The mixing area **310** may be substantially conical in shape.

[0028] The mixture inlet **230** may pass through the nozzle body **240** to the mixing area **310**. The mixture inlet **230** may be a hollow region in the nozzle

body between the inner wall **250** and the outer wall **260** that allows the mixture hose **220** to fit into the nozzle body **240** and allows the milk and air mixture to pass to the mixing area **310**. The mixture inlet **230** also is contemplated to include an insert or any other means of allowing the mixture hose **220** to feed the mixture into the mixing area **310**. The mixture inlet **230** may include a barbed connector. The present invention is not limited to pre-mixing the pressurized air and milk prior to the mixing area **310**. It is contemplated that the milk and air may enter the mixing area **310** jointly or separately.

[0029] The foamed milk system **100** also may include a pressurized steam inlet system **235** that provides steam to the foamed milk system **310**. The steam inlet system **235** may include a steam generator **270**, a steam hose **280**, and a steam inlet **290**. The steam generator **270** may be a heat exchanger, a boiler, or any other device that creates pressurized steam. Steam in the present embodiment may be pressurized to about forty (40) psi (about 2.8 ksc) or so. The pressure may be higher or lower depending on the rate of foam production required. The steam hose **280** may be used to transport the pressurized steam from the steam generator **270** to the steam inlet **290**. The steam hose **280** may be made out of copper, stainless steel, other types of metals, plastics, rubber, or other types of substantially non-corrosive materials as are described above. The steam hose **280** may be attached to the nozzle body **240** by fitting the steam hose **280** into the steam inlet **290** by a clamping mechanism or by any other method known in the art.

[0030] The steam inlet **290** may pass through the nozzle body **240**. The steam inlet **290** may be a hollow region in the nozzle body **240** between the inner wall **250** and the outer wall **260** that allows the steam hose **280** to fit into the nozzle body **240** and the steam to pass to the mixing area **310**. The steam inlet **290** may include a barbed connector. It is also contemplated that the pressurized steam may be pre-mixed with the pressurized milk and/or air prior to entering the mixing area **310**.

[0031] As described above, the inner wall **250** of the nozzle body may define the mixing area **310**. The inner wall **250** and the mixing area **310** may be

tapered to allow a nozzle insert **300** to fit therein. The nozzle body **240** may be made of stainless steel, aluminum, plastic, or any other substantially non-corrosive material. The nozzle insert **300** may be tapered in a similar manner as the mixing area **310** so as to allow the insert **300** to fit inside of the nozzle body **240**. The nozzle insert **300** may be solid or hollow.

[0032] The nozzle insert **300** may be locked into the nozzle body **240** by using a twist lock mechanism, by a screwing mechanism, or by any other attachment means known in the art. The screwing mechanism, for instance, may include a screw attached to the top end of the nozzle insert **300** that screws into a threaded channel in the nozzle body **240**.

[0033] The insertion of the nozzle insert **300** may create an annular region between the inner wall **250** of the nozzle body **240** and the nozzle insert **300**. The annular region defines the mixing area **310** for the milk, air, and steam. In the mixing area **310**, the milk, air, and steam become intimately mixed so as to increase the efficiency of the system. As depicted in Figs. 2 and 3, the nozzle insert **300** also may contain a number of protrusions **320** to aid in the mixing of the milk, air, and steam. The protrusions **320** may contact the inner wall **250** of the nozzle body **240** when the nozzle insert **300** is placed inside the nozzle body **240**. The spaces between the protrusions **320** may create a number of orifice areas **330**. The use of the protrusions **320** in the mixing area **310** may promote turbulent fluid flow therein. This turbulent fluid flow may enhance mixing of the milk, air, and steam passing there through. However, turbulent flow is not required so long as sufficient mixing is achieved.

[0034] In an exemplary embodiment of the present invention, the nozzle body **240** may be about three (3) inches (about 7.6 centimeters) long and substantially cylindrically shaped. The nozzle insert **300** also may be substantially cylindrically shaped and about one (1) inch (about 2.5 centimeters) long and about 0.6 inches (about 1.5 centimeters) in diameter at the base. The inner wall **250** of the nozzle body **240** and the nozzle insert **300** may be tapered at about a 10.5 degree angle. The nozzle insert **300** may only be tapered for about 0.8 inches (2 centimeters) of the length and the remaining length may not be

tapered. The exemplary embodiment may include about two (2) rows of protrusions **320** with about sixteen (16) protrusions **320** per row within the mixing area **310**. The protrusions **320**, in the exemplary embodiment, may be about 0.029 inches (about 0.7 millimeters) tall and about 0.06 inches (1.5 millimeters) wide. The rows may be about one-third inch (about 0.85 centimeters) apart. Any number of protrusions **320**, rows of protrusions **320**, or size of protrusions **320** is contemplated so as to enhance the mixing of the milk, air, and steam. Further, the present invention is not limited to the dimensions in the exemplary embodiment. The nozzle body **240** and the nozzle insert **300** are contemplated to be any size and tapered at any angle that may create an adequate space for use with the present invention.

[0035] Adjacent to the mixing area **310** may be an expansion area **340**. The expansion area **340** may be located where the annular region between the inner wall **250** of the nozzle body and the nozzle insert **300** begins to widen or ends. The expansion area **340** may be at or about ambient pressure. As the pressurized milk, air, and steam mixture reach the expansion area **340** from the mixing area **310**, the mixture may begin to expand as the pressure of the mixture is reduced to about ambient pressure. This expansion may cause the milk, air, and steam mixture to foam as the pressure is reduced.

[0036] The foam then may be collected using a diffuser **350**. The diffuser **350** may be used to control and collect the foam from the expansion area **340** and dispense the foam into a cup or mug **380**. The diffuser **350** may include a diffuser insert **360** and a spout **370**. The diffuser insert **360** may be cylindrically shaped and may be tapered to funnel the foam to the spout **370**. The diffuser **350** may be made of stainless steel, aluminum, plastic, or any other substantially non-corrosive material. Any type of diffuser system is contemplated herein that allows the user to collect and dispense the foam into a cup or mug **380**.

[0037] The diffuser insert **360** and the bottom of the nozzle body **240** may be threaded so as to allow them to be screwed together. The diffuser insert **360** also may snap into the nozzle body **240** or be connected in any other means known in the art. The spout **370** may be threaded and screwed into the bottom of

the diffuser insert **360**, snapped into the bottom portion of the diffuser insert **360**, or connected to the diffuser insert **360** in any other manner known in the art.

[0038] The exemplary embodiment may produce about eight (8) ounces (about 236.6 milliliters) of foam for an individual serving. The foam may be produced at a rate of about 0.375 ounces/second (about 11 milliliters/second) by providing pressurized milk at about 0.375 ounces/second (about 11 milliliters/second) for about eight (8) seconds, pressurized air at about fifteen (15) psi (about one (1) ksc) for about eight (8) seconds, and pressurized steam at about fifteen (15) psi (about one (1) ksc) for about eight (8) seconds into the mixing area **310**. The temperature of the milk may be about 155 degrees Fahrenheit (about 68.3 degrees Celsius) or so. The temperature of the nozzle body **240** may reach about 212 degrees Fahrenheit (about 100 degrees Celsius). The present invention is in no way limited to the exemplary embodiment and can be of any size, dimension, operating conditions, and flow rates necessary for the desired foam production.

[0039] The foamed milk system **100** also may be used to produce steamed milk for lattes and other hot beverages. The foamed milk system **100** may be used in substantially the same manner to produce steamed milk as it is used to produce foamed milk. Steamed milk may be produced by only introducing milk and steam into the foamed milk system **100**. Thus, the pressurized air inlet system **160** would not be used. Milk from the pressurized milk inlet system **110** and steam from the pressurized steam inlet system **235** may be introduced to the mixing area **310**, expanded in the expansion area **340**, collected with the diffuser **350**, and dispensed into the mug or cup **380** to produce the steamed milk desired. The present embodiment may pressurize the milk to about fifteen (15) psi (about 1 ksc) and the steam to about forty (40) psi (about 2.8 ksc) to produce steamed milk at a rate of about six (6) ounces per second (about 177.4 milliliters per second). Any pressure, however, may be used to accommodate a similar or different steamed milk production rate.

[0040] The foamed milk system **100** also may include a sanitation system **500**. The sanitation system **500** may include a source of hot water **510**. The hot

water supply **510** may be the hot water storage tank of a coffee brewer (not shown) or a similar type of device. The hot water supply **510** may be connected to the air hose **180** via a hot water hose **520**. A sanitation valve **530** may open and shut the hot water hose **520**. The sanitation valve **530** may be a solenoid valve or a similar type of device. A T-joint **540** or a similar type of device may join the air hose **180** and the hot water hose **520**. One or more check valves **550** may be placed on either side of the T-joint **540** to prevent backflow.

[0041] In order to flush the milk system **100**, the sanitation valve **530** is opened and allows hot water to flow from the hot water source **510** through the hot water hose **520** and the check valves **550**. The hot water is delivered to the hose connector **185**, the mixture hose **220**, and the nozzle body **240**. A sufficient quantity of water is delivered to ensure that all internal services reach a temperature of at least about a 190 degrees Fahrenheit (about 87.8 degrees Celsius). T his flush cycle ensures that all elements outside o f t he refrigerated container **155** or in connection with a non-refrigerated element are flushed and sanitized. The flush cycle preferably is repeated about every two (2) hours or so.

[0042] Sanitation is further improved by the milk hoses **140, 150** and the mixture hose **220** being disposable. As such, the hoses **140, 150, 220** may be replaced daily. Likewise, the hose connector **185** and the nozzle insert **300** of the nozzle body **240** may be removed and sanitized each day. Further, the connectors used herein may be barbed to prevent crevice build up. The milk system **100** thus provides for quick and easy cleaning and sanitation.

[0043] Alternatively, the foamed milk system **100** also may include a cleaning block junction **390** depicted in Fig. 4. The cleaning block junction **390** may replace the hose connector **185**. The cleaning block junction **390** may contain four (4) hose fittings **400, 410, 420, 430**. The first three (3) fittings **400, 410, 420** may be connected to the milk hose **150**, the air hose **180**, and the mixture hose **220** in the manner described above with respect to the hose connector **185**. The fourth fitting **430** may be connected to a flush water hose (not shown). Hot water may be forced through the flush water hose and into the cleaning block junction **390** to sterilize the foamed milk system **100**. The hot

water may travel through the mixture hose **220**, the mixture inlet **230**, the mixing area **310**, the expansion area **340**, and the diffuser **350** to sterilize the foamed milk system **100** as is described above. The system **100** as a whole may then be reoriented to producing the steamed milk and foam as is described above.

[0044] It should be apparent that the foregoing relates only to the preferred embodiments of the present invention and that numerous changes and modifications may be made herein without departing from the spirit and scope of the invention as defined by the following claims and equivalents thereof.